

### III. TRENDS IN MILITARY SPENDING

In measuring military trends, as in measuring economic trends, no single indicator suffices to evaluate major developments in individual countries over time or to compare numerous countries at any point in time. Besides annual and cumulative military spending and accumulated stocks of military equipment, relevant indicators of military strength include order-of-battle data on forces and weapons (both conventional and nuclear); military training, morale, and leadership; command, control, communications, and intelligence; operational readiness; air and sea lift; research and development; and defense mobilization capabilities.

For a very rough indicator of military trends over the 1950–2010 period, we have focused on two aggregate measures of military efforts and military power: first, annual military spending expressed in 1986 U.S. dollars for each of the 15 countries; second, annual estimates of the military capital stock of each country, representing the net value of military equipment and structures held by each country, also expressed in 1986 U.S. dollars for each year of the 60-year period.

Estimates of *military spending* for the period from 1950 to the present are derived from several international as well as national sources in the 15 countries.<sup>1</sup> For the period from the present to 2010, the spending estimates are linked to prior GNP estimates through parameters relating to each country's military burden (the ratio of military spending to national product). These burden parameters were derived from historical and recent experience in each of the 15 countries, combined with explicit judgments about how the parameters may in the future diverge from historical experience. We have not attempted to estimate confidence intervals for these parameters.

#### U.S. AND SOVIET ALTERNATIVES AND COMPARISONS

For the United States, the burden parameter is assumed in the base case to average 6.2 percent of GNP over the next two decades. Two alternatives are also presented, reflecting sharply different burden assumptions and sharply tighter resource constraints:

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<sup>1</sup>See the appendix for a description of sources used for each of the 15 countries.

1. *Alternative 1* assumes constant levels of real annual U.S. military spending; with this assumption, the burden parameter declines from 6.2 percent in 1988 to 4.5 percent in 2000 and 3.5 percent in 2010.
2. *Alternative 2* allows for a 1 percent annual growth in real U.S. military spending from 1988 onwards. Because U.S. GNP is estimated to grow at an average rate of about 2.6 percent, the military spending share of GNP in this alternative falls to 5.1 percent in 2000 and 4.3 percent in 2010.

In terms of the current budgetary outlook, either Alternative 1 or 2 seems more probable than the base case.

For the Soviet Union, four alternatives to the base-case estimates are calculated. The Soviet base case assumed that Soviet GNP in 1985 represented about one-half the U.S. GNP, and Soviet military spending was 14.3 percent of its GNP. The first of these two assumptions is very likely too high, while the Soviet military spending share of GNP is probably considerably above 14.3 percent. Therefore four alternatives were constructed as follows:

1. *Alternative A* assumed the same initial 1985 level of Soviet GNP as in the base case, a tripling of productivity growth ("*perestroika* succeeds"), and a reduced military spending share in GNP (13.1 percent).
2. *Alternative B* assumed an initial 1985 level of Soviet GNP that was 25 percent below the base-case level, slow productivity growth ("*perestroika* fails"), and a higher military spending share in GNP (18.9 percent).
3. *Alternative C* assumed the same 1985 GNP level adopted in Alternative B, the productivity growth of Alternative A, and a military spending share varying between 18.5 percent and 18.9 percent.
4. *Alternative D* is the same as Alternative A except that Soviet military spending remains constant from 1990 to 2010; therefore, the military burden ratio falls to 9.3 percent in 2000 and 6.7 percent in 2010.

Table 5 summarizes the base-case military spending estimates for the 15 countries. Annual Soviet military spending remains above that of the United States through the early 1990s, if the base-case assumptions are sustained (14.3 percent military

Table 5

ANNUAL MILITARY SPENDING  
BY SELECTED COUNTRIES,  
1950-2010  
(In billions of 1986 U.S. dollars)

Nation	1950	1960	1970	1980	1990	2000	2010
United States	69	168	209	196	288	365	462
Soviet Union	91	95	170	247	299	351	411
Japan	4	4	7	14	22	29	37
China	8	16	37	45	53	120	218
West Germany	0	20	21	27	32	40	49
United Kingdom	23	29	26	29	35	42	50
France	11	22	21	28	34	45	57
India	2	4	9	12	24	36	53
South Korea	1	1	1	5	9	15	23
Taiwan	1	1	2	3	6	11	19
Brazil	1	1	3	1	3	4	7
Argentina	1	1	2	3	3	3	3
Turkey	2	3	5	8	12	17	23
Mexico	0	1	1	2	2	3	3
Egypt	1	2	9	7	9	11	13

spending share for the Soviet Union and 6.2 percent for the United States) and if our calculated U.S. and Soviet growth rates are realized.

However, these conclusions are substantially altered if, instead, our alternative assumptions are used. Table 6 summarizes the U.S.-Soviet spending comparisons for Alternatives 1 and 2 and A through D. Among the Soviet alternatives, Alternative A generates the largest military spending because of the combined effect of the higher initial (1985) level of Soviet GNP and the rise of productivity, notwithstanding a relatively low military burden.

As Table 6 indicates, in both U.S. Alternatives 1 and 2—which assume constant and slow growth military spending, respectively—the U.S. figures are substantially lower by 2000 than Soviet military spending. If Soviet economic reforms result in sharply raised productivity and if Soviet military spending remains about as large a share of Soviet GNP as it has been, U.S. military spending would, under Alternatives 1 and 2, be well below that of the Soviet Union unless Soviet military spending were to be held constant, as illustrated by Alternative D.<sup>2</sup>

<sup>2</sup>Obviously, U.S. and Soviet defense efforts are likely to influence each other. Moreover, *perestroika* in the Soviet Union could affect the size of the Soviet defense effort.

Table 6

ANNUAL U.S. AND SOVIET MILITARY SPENDING,  
ALTERNATIVES AND BASE CASES, 1985-2010  
(In billions of 1986 U.S. dollars)

Category	1985	1990	2000	2010
<i>Soviet Union</i>				
Base case (military burden 14.3%)	285	299	351	411
Alt. A ( <i>perestroika</i> succeeds I, low military burden ~13%)	285	314	441	615
Alt. B ( <i>perestroika</i> fails, high military burden ~19%)	285	296	345	402
Alt. C ( <i>perestroika</i> succeeds II, high military burden ~19%)	285	296	382	495
Alt. D ( <i>perestroika</i> succeeds III, constant military spending and decreasing military burden)	284	314	314	314
<i>United States</i>				
Base case	270	288	365	462
Alt. 1 (constant military spending)	270	276	276	276
Alt. 2 (slow growth military spending)	270	281	310	338

## MILITARY SPENDING IN OTHER COUNTRIES

The comparisons shown in Fig. 7 and Table 5 for other countries suggest several noteworthy points.

- Military spending by China rises substantially and significantly due to both the relatively rapid growth of China's GNP (between 4 percent and 5 percent per annum) and the relatively large and rising share of GNP devoted to the military after 1990. (As and if China's three "economic modernizations"—in agriculture, industry, and technology—are realized, the Chinese defense burden will probably rise from about 3.5 percent to about 6 percent of GNP between 1990 and 2010, as military modernization proceeds.)
- Whereas Chinese military spending in 1980 and 1990 is less than a fifth that of the Soviet Union and a quarter that of the United States, by 2000 Chinese military spending will be about a third of the U.S. and Soviet figures and by 2010 about half their sizes. In terms of aggregate military spending, China

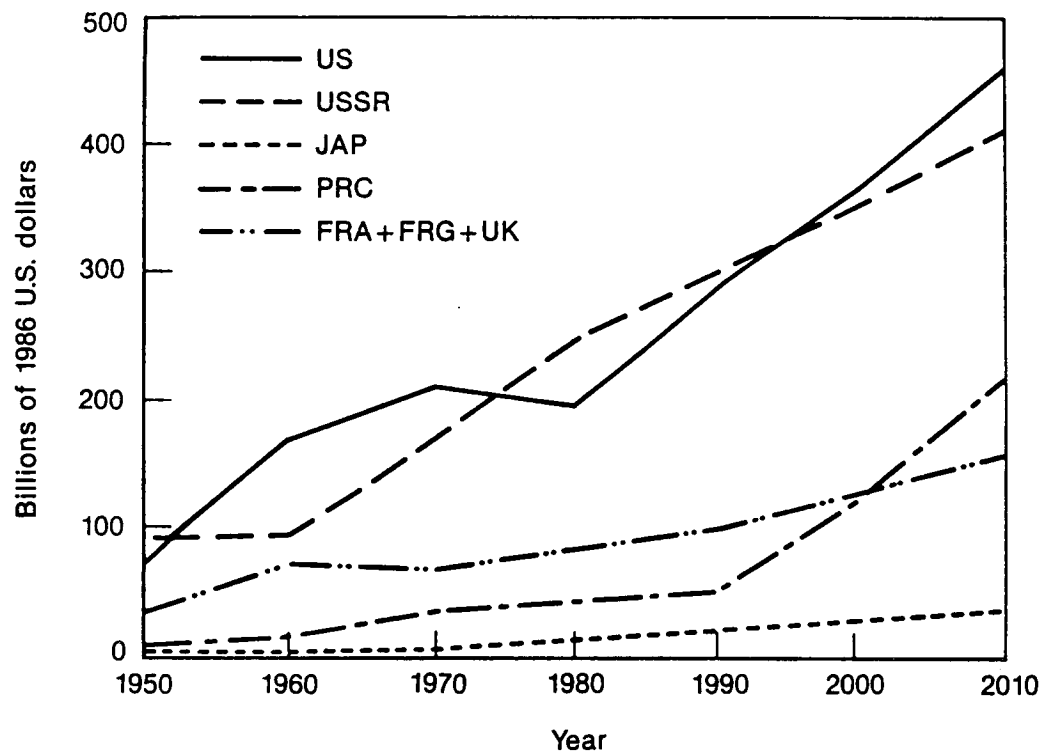


Fig. 7—Annual military spending: United States, USSR, Japan, China and three NATO countries

becomes more significant in the spending balance between the United States and the Soviet Union during the rest of this century and into the 21st century. Repercussions from increased Chinese military spending might ensue elsewhere in Asia, especially in Japan and perhaps India, but these possibilities are not reflected in Table 5.

- Defense spending by Japan remains small relative to those of the United States and the Soviet Union. Nevertheless, because of the expansion and size of Japan's economy, even a relatively small defense burden results in rising real levels of Japanese defense spending which, toward the end of the century, approaches the spending levels of each of our principal West European allies. If, in response to increased military efforts by China or for other reasons, Japan were to boost its defense share of GNP to, say, 3 percent, the effects would be significant: by 1990, Japan's military spending would be over 60 percent as large as the combined military spending of the

UK, West Germany, and France, and by 2000, the Japanese figures would be nearly 70 percent of their combined military spending.

- Defense spending by our principal West European allies (the United Kingdom, West Germany, and France) is estimated as falling relative to that of the United States between 1980 (when their spending was about 43 percent of ours) and 2010 (when their spending declines to about 32 percent of ours). However, military spending by these three West European allies would represent, in 2010, about the same proportion of the corresponding Soviet figure, and therefore would remain a highly significant element in the U.S.-Soviet balance. (The possibility that European military spending might rise, perhaps to compensate for possible reductions in U.S. NATO spending, is not reflected in these estimates.)

#### IV. MILITARY CAPITAL STOCKS

The following estimates of *military capital stocks* for the 15 countries cover their respective holdings of weapons and structures over the 1950–2010 period. The estimates are based on two very rough, order-of-magnitude approximation methods, each applied to particular countries depending on whether the available data made one or the other more appropriate. Both methods require a benchmark capital stock measure for at least a single year to generate the entire 1950–2010 series.

To provide this benchmark where one did not already exist from another source, one method began with an estimate of defense spending devoted to military investment in 1950; then it built up the subsequent years' estimates by adding new investment and depreciating the accumulated military capital stock at a "forward" rate,  $\partial_1$ .

For the other method, the capital stock in 1985 was estimated from a country's inventory of military equipment that had been scaled to other countries in the sample. In this case, estimates for the earlier years were constructed by *subtracting* each prior year's military investment and *adding* depreciation from that year's capital stock at a "backward" depreciation rate,  $\partial_2$ .

Based on the U.S. capital stock data, which are available for all of the 1950–1985 period, a "forward" depreciation rate of 3.5 percent and a "backward" rate of 4.5 percent yield a close approximation of the actual data series. These rates were therefore used for other countries, depending on which of the two approximation methods was applied.<sup>1</sup>

In both methods, military capital estimates for the 1980s through 2010 were derived by adding new military investment, as a share of total military spending, and subtracting depreciation from the annual capital stock figures. Table 6 summarizes the results of these calculations, Fig. 8 displays the results for the major countries, and Fig. 9 shows the several comparisons between U.S. and Soviet military capital stocks that result from alternative assumptions about their respective levels of military investment.

As Table 7 and Fig. 8 indicate, Soviet military capital stock is expected to be above that of the United States until 2000, falling below the U.S. level by about 11 percent in 2010. This compares with a 28 percent Soviet advantage in 1980. As noted

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<sup>1</sup>For a more complete explanation of the methods and data, see the appendix.

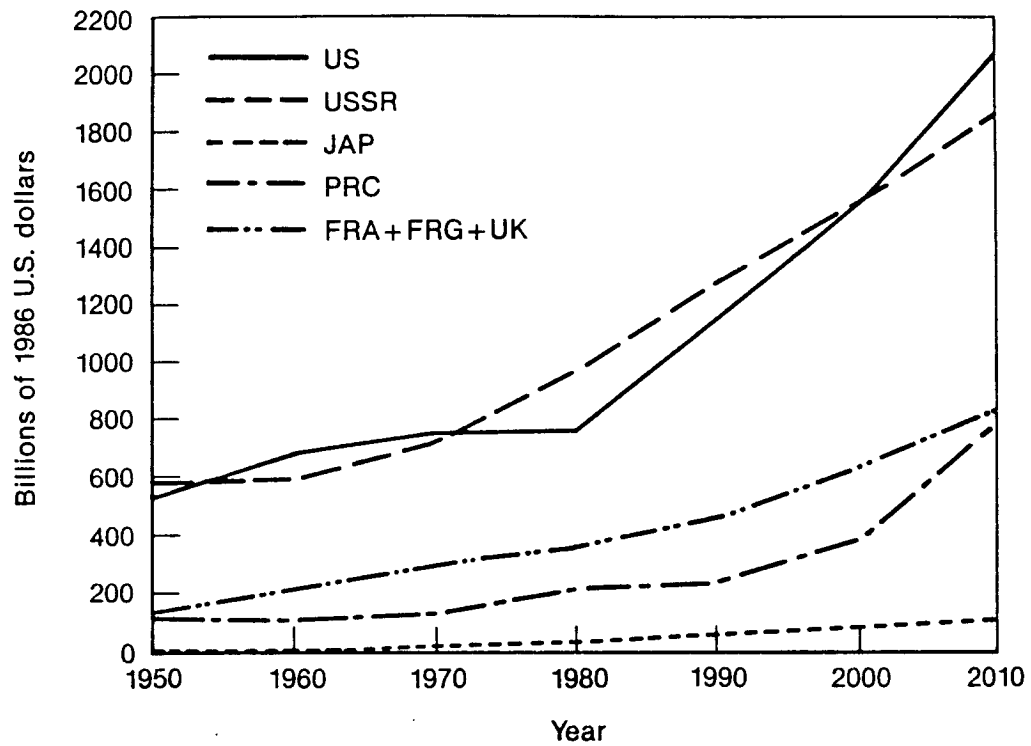


Fig. 8—Military capital stocks: United States, USSR, Japan, China and three NATO countries

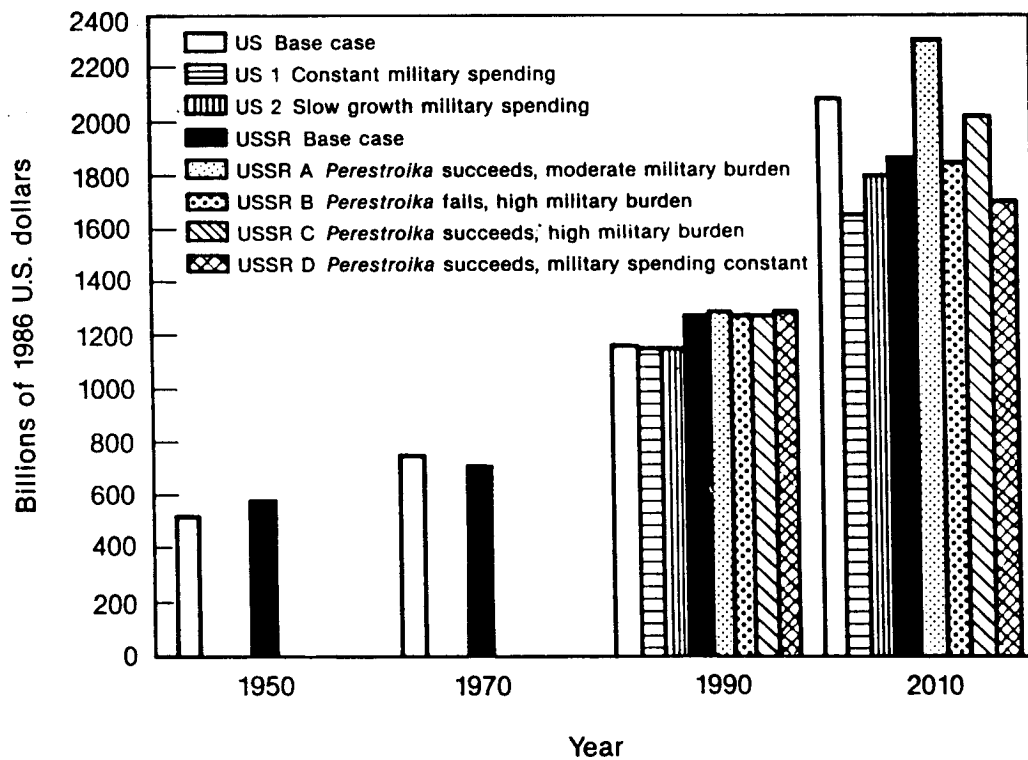


Fig. 9—Military capital stocks: United States (base and Alternatives 1 and 2) and USSR (base and Alternatives A through D)



Table 7

MILITARY CAPITAL STOCKS (WEAPONS AND STRUCTURES)  
OF SELECTED COUNTRIES, 1950-2010  
(In billions of 1986 U.S. dollars)\*

Nation	1950	1960	1970	1980	1990	2000	2010
United States	525	677	747	755	1157	1562	2089
Soviet Union	584	592	719	965	1278	1559	1867
Japan	0	6	15	31	55	82	115
China	107	103	129	211	236	392	785
West Germany	0	24	68	101	138	197	260
United Kingdom	78	113	130	139	171	227	284
France	52	74	91	107	148	215	292
India	8	9	15	21	42	81	131
South Korea	1	1	2	15	37	75	131
Taiwan	3	4	6	10	15	24	40
Brazil	7	6	8	9	10	12	18
Argentina	7	7	7	8	11	12	14
Turkey	5	8	12	23	33	48	68
Mexico	5	4	5	6	8	10	12
Egypt	18	14	17	37	39	44	51

\*Converted from local currencies using 1980 purchasing-power parities.

earlier, the U.S. base case, on which this comparison is predicated, makes the dubious assumption that U.S. military spending will remain at about the same share (6.2 percent) of GNP in the next two decades that it represented in the mid 1980s. The picture changes sharply if U.S. military spending is held constant (Alt. 1) or grows slowly (Alt. 2), and still more sharply if Soviet productivity rises (*perestroika* succeeds) and the defense burden remains moderate or high (Alt. A or Alt. B). On the other hand, if both the Soviets and the United States were to maintain military spending at their current levels (Alt. D for the Soviets and Alt. 1 for the United States), their respective military capital stocks in 2010 would be about equal.

Table 8 shows the effects of the alternatives on U.S. and Soviet military capital stocks.

Regarding Table 7 and Figs. 8 and 9, several points are worth noting:

- China's military capital stock, hitherto small relative to those of the United States and the Soviet Union, rises to roughly 40 percent of each superpower's military capital stock by 2010. In terms of aggregate military stock comparisons, China becomes the balancing item in the parity between the Soviet Union and the United States from 1990 into the 21st century. In

Table 8

ALTERNATIVE U.S. AND SOVIET MILITARY  
CAPITAL STOCKS, 1985-2010  
(In billions of 1986 U.S. dollars)

Category	1985	1990	2000	2010
<i>United States</i>				
Base case	950	1157	1562	2089
Alt. 1 (constant military spending)	[a]	1154	1432	1648
Alt. 2 (slow growth military spending)	[a]	1155	1479	1796
<i>Soviet Union</i>				
Base case	1131	1278	1559	1867
Alt. A ( <i>perestroika</i> succeeds I, moderate military burden)	1131	1288	1686	2293
Alt. B ( <i>perestroika</i> fails, high military burden)	1131	1277	1548	1842
Alt. C ( <i>perestroika</i> succeeds II, high military burden)	1131	1277	1589	2021
Alt. D ( <i>perestroika</i> succeeds III, military spending constant)	1131	1288	1543	1696

<sup>a</sup>Not computed.

relation to regional military balances, the Chinese military capital stock in 2010 will be about six times that of India; currently, their ratio is about 7 to 1.

- The accumulating military capital of the principal West European allies will remain about as significant in the balance between the United States and the Soviet Union as it has in the past. Thus, in 1980 the military capital of France, West Germany, and the United Kingdom amounted to about 46 percent of the U.S. figure; by 2010, the corresponding ratio is about 40 percent (836 billion 1986 U.S. dollars for the three European countries versus 2,089 billion for the United States).
- Japan's military capital stock remains small relative to the other countries but, by the early part of the 21st century, its military capital reaches about 40 percent of that of each of our principal West European allies. Of course, if Japan's military spending were to increase appreciably—in response to China's military modernization or for other reasons—the resulting effects on Japan's military capital would be consequential. For example, if Japan were

to increase its military spending to, say, 3 percent of GNP in 1990, by 2000 the Japanese military capital stock would be 70 percent that of West Germany; by 2010 Japanese military capital would reach \$321 billion, about 24 percent above that of West Germany.

- Although the military capital of the middle regional powers (Korea, Taiwan, Turkey, India, Brazil, Egypt) is small relative to that of the larger powers, it represents a formidable stock of weapons, very likely including advanced systems, in the next two decades.

Along with increases in their military capital stocks, as well as growth of their economies and their technological sophistication, these middle regional developing countries will acquire a growing capacity to produce and to export a wide range of weapons, including all but the most sophisticated types. This trend is already evident as indicated by these countries' increased share of the \$30–40 billion annual level of world arms exports: from 2 percent in 1973 to 11 percent in 1984,<sup>2</sup> although this percentage apparently decreased in 1985 and 1986. By the 1990s, arms exports by Brazil, both Koreas, and India, as well as China, are likely to reach a still larger and more significant scale.

Two important general conclusions emerge from combining the estimates of major economic trends and trends in the military aggregates: first, looking forward to the rest of this century and the beginning of the 21st century, whether Japan and China are allied, friendly, neutral, or belligerent vis a vis the United States will be no less important for U.S. interests than is the continued adversarial posture of the Soviet Union; second, inasmuch as some of the middle-level regional powers are likely to gain in economic and military capabilities and are likely to be more prominent actors in the international arena, U.S. policy formulation will probably grow increasingly concerned with closer cooperation and coalitions with them.

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<sup>2</sup>See Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers 1987*, Washington, D.C., 1988, pp. 10–11.